LaMotte

CON 6 PLUS
TDS 6 PLUS

CE

PREFACE

This manual serves to explain the use of the Conductivity and TDS handheld meters. The models covered are the CON 6 PLUS and TDS 6 PLUS.

This manual functions in two ways: first as a step by step guide to operating the meter; second, as a handy reference guide.

This manual is written to cover as many anticipated applications of the Conductivity and TDS handheld meters as possible. If there are questions about the use of this meter contact the LaMotte Tech Service Department.

LaMotte Company will not accept any responsibility for damage or malfunction to the meter caused by improper use of the instrument.

The information presented in this manual is subject to change without notice as improvements are made, and does not represent a commitment on the part of LaMotte Company.

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

TABLE OF CONTENTS

1. INTRODUCTION

The CON 6 PLUS and TDS 6 PLUS microprocessor-based handheld meters are economical and easy to use. They have a large custom LCD (Liquid Crystal Display) for clear and easy reading.

The CON 6 PLUS measures conductivity (µS/cm or mS/cm) and temperature (°C) while the TDS 6 PLUS measures total dissolved solids (TDS) in parts per million (ppm) or parts per thousand (ppt) and temperature (°C). Each meter measures up to 5 different ranges and will automatically switch to appropriate measuring range.

The meters include a probe (cell constant K = 1.0) with built-in temperature sensor, rubber boot, 4 alkaline "AAA" batteries and instruction manual. For additional information, see Section 13 — *REPLACEMENT PARTS AND ACCESSORIES*.

Read this manual thoroughly before operating the meter.

2. GETTING STARTED

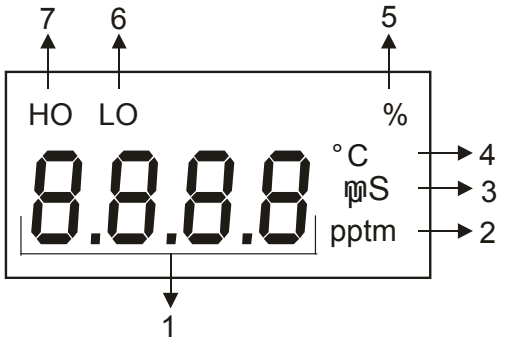
2.1 Description of Keypad Functions

The meter has 6 keys on the splash-proof keypad. Some buttons have multiple functions depending on the mode of operation.

ON/OFF	Powers meter on and off. Meter starts up in the measurement mode that was last used.
CAL	Enters into calibration mode. Pressing while in calibration mode will abort calibration without confirming value.
MODE	Selects desired measurement mode. When pressed simultaneously with ON/OFF, it will take proceed the SETUP mode. See ADVANCED SETUP section for more information.
HOLD	Freezes measured reading. Press again to resume live reading.
ENTER	Confirms calibration value in calibration mode and confirm selections in SETUP mode.
▲	Increments values during calibration mode or scroll through SETUP. Activates manual ranging function during conductivity / TDS measurement.
▼	Decrements values during calibration mode.

2.2 Description of LCD Annunciators

The meter has a large custom LCD that consists of 4-digit segments plus annunciators for uS/mS (CON 6 PLUS), ppm/ppt (TDS 6 PLUS), and °C (temperature).



1. Primary display
2. Parts per million (ppm) or parts per thousand (ppt) (TDS 6 PLUS)
3. Millisiemens/cm (mS) or microsiemens/cm (µS) indicator (CON 6 PLUS)
4. Temperature indicator
5. Percentage indicator for temperature coefficient
6. “LO” = low battery condition
7. “HO” = HOLD function is activated and reading is frozen

2.3 Inserting & Removing the Rubber Boot/Stand

1. To remove the meter from the rubber boot, push out the bottom edge of the meter until it is completely out of the boot. Ensure that the probe cables are not connected. Figure 1.
2. To insert the meter into the rubber boot, slide in the top of the meter before pushing the bottom edge of the meter down to set it into position. Lift up the stand at the back of meter for bench top applications. Figure 2.

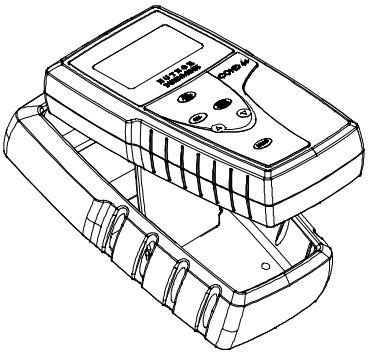


Figure 1

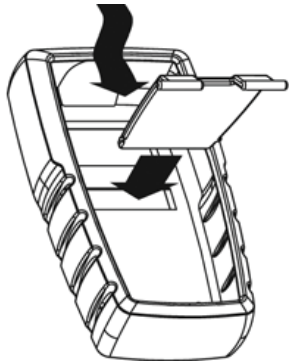
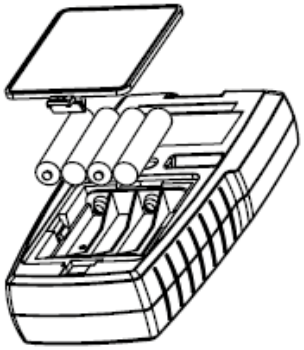
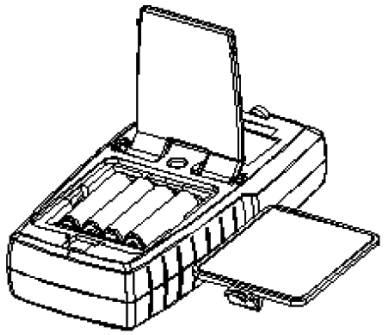


Figure 2

2.4 Inserting New Batteries

The battery compartment is found at the back of the instrument. To open the battery compartment, push the cover in the direction of the arrow and lift up. Note the polarity of the batteries before inserting them into position. After the batteries have been replaced, reposition the cover and press down until it locks.





2.5 Battery Replacement

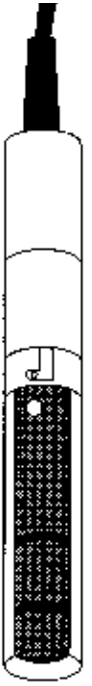
The “LO” annunciator on the LCD alerts when battery power is running low.

Caution: Power off the meter before changing battery.

“LO” Battery Condition

2.6 Electrode Information

The meter includes a probe with a BNC connector having a nominal cell constant of k = 1.0, and a built-in temperature sensor. The Ultem-body housing has good chemical resistant properties. The probe design offers fast temperature response and reduces air entrapment, ensuring accurate, repeatable, and stable readings.



The wettable materials of the probe include:

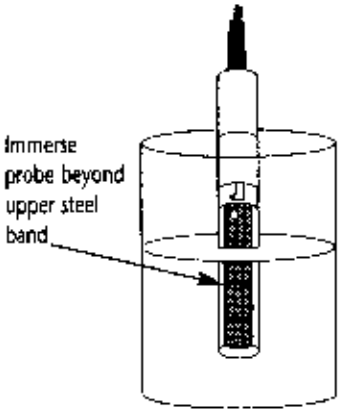
1. Polyetherimide (Ultem) – protective probe guard
2. Polybutylterphalate (Valox) – sensor housing
3. Stainless Steel (SS 304) – 2 steel bands

The protective probe guard can be removed temporarily for maintenance but must be reattached before measurement and calibration. *Erroneous results will occur during calibration and measurement if the probe guard is not used*.

Always immerse the probe beyond upper steel band for best results. Use the fill line on the outside of the probe guard for reference.

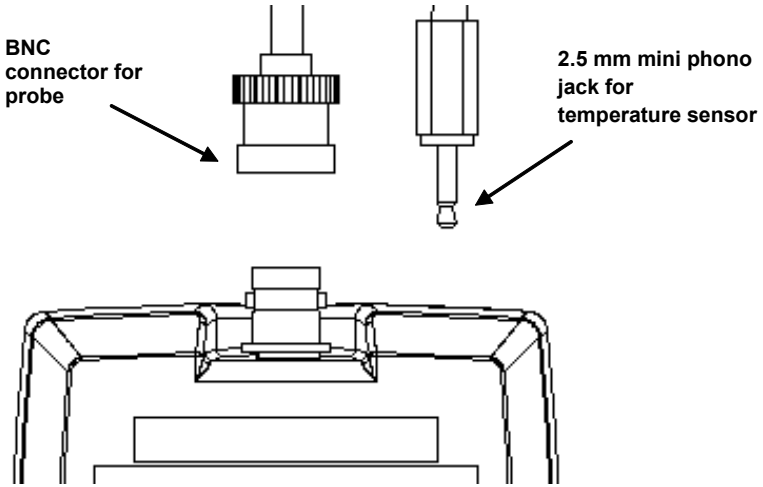
1. DO NOT perform calibrations or measurements without the protective probe guard in place.
2. Immersion above the protective guard is not recommended. The cable can be submerged briefly but is not designed for continuous immersion.

See "*Probe Care and Maintenance*" for more information.



2.7 Connecting the Probe

1. To connect the probe, align the connector slots with the posts of the meter socket and rotate the connector clockwise until it locks.
2. To remove the probe, rotate the connector in anti-clockwise direction until it unlocks, and slide the connector off the socket.
3. Insert the mini phono jack of the temperature sensor into the socket on the meter as shown below.



2.8 Switching the Meter On

Press **ON/OFF** to power up the meter. The meter will cycle through various setup parameters when switched on.

1. The first screen will show the model [Con6] [tdS6].
2. The second screen will show the nominal cell constant value. The CON 6 PLUS and TDS 6 PLUS meters can accept electrodes with k = 0.1, 1.0 or 10.0 nominal cell constants. Default value is k = 1.0 [**C 1.0**].

   See Section 5.2 *Advanced Setup* to modify.

3. The third screen will show the Normalization Temperature which can be set to 25 °C or 20 °C. The default value is 25 °C [**t 25.0 °C**].

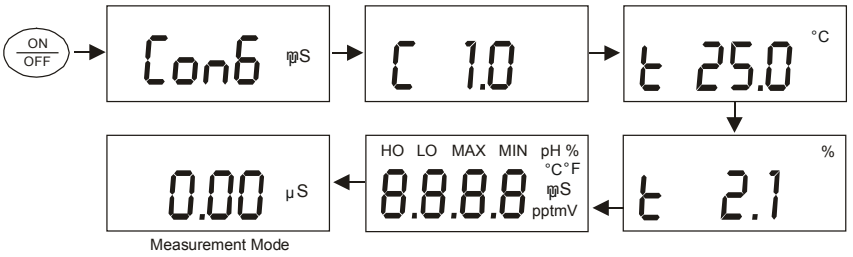
   See Section 5.6 *Advanced Setup* to modify.

4. The fourth screen will show the Temperature Coefficient which can be set from 0.0 to 3.0 % per °C. Default value is 2.1 %/°C [**t 2.1%**].

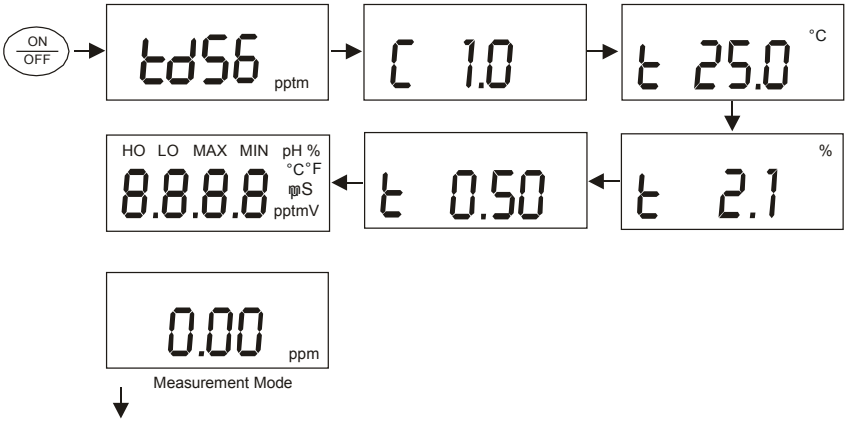
   See Section 5.5 *Advanced Setup* to modify.

5. All LCD segments will light for 2 seconds before entering the measurement mode. Note: The meter will use the measurement mode that was in use when it was powered off.

CON 6 PLUS



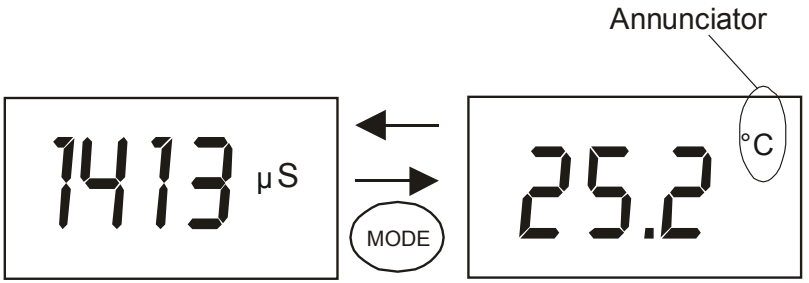
Measurement Mode



2.9 Changing the Mode

To switch between conductivity or TDS measurement mode and temperature measurement mode, press the **MODE** key.

The annunciator will indicate the measurement mode.



3. CALIBRATION

3.1 Important Information on Meter Calibration

The CON 6 PLUS and TDS 6 PLUS have five measuring ranges listed below. Each range can be calibrated to one point per range (five total points if each range is calibrated). Calibration is recommended for each range that will be utilized.

CON 6 PLUS

Conductivity Range	Recommended Calibration Solution Range
0.00 ⟹ 20.00 µS/cm	6.00 to 17.00 µS/cm
0.0 ⟹ 200.0 µS/cm	60.0 to 170.0 µS/cm
0 ⟹ 2000 µS/cm	600 to 1700 µS/cm
0.00 ⟹ 20.00 mS/cm	6.00 to 17.00 mS/cm
0.0 ⟹ 200.0 mS/cm	60.0 to 170.0 mS/cm

TDS 6 PLUS

TDS Range	Recommended Calibration Solution Range
0.00 ⟹ 10.00 ppm	3.00 to 8.50 ppm
10.0 ⟹ 100.0 ppm	30.0 to 85.0 ppm
100 ⟹ 1000 ppm	300 to 850 ppm
1.00 ⟹ 10.00 ppt	3.00 to 8.50 ppt
10.0 ⟹ 200 ppt	30.0 to 170 ppt

New calibrations will replace old calibrations on a per range basis. For example, if the meter has been calibrated with 1413 µS/cm (0 to 2000 µS/cm range) and a calibration is performed with 1500 µS/cm (also 0 to 2000 µS/cm range), the meter will replace the 1413 µS/cm calibration in that range. The meter will retain all calibration data in other ranges.

When the probe is replaced, it is best to clear all calibration data. To erase all calibration data completely, see *Section 5.8 Restore Factory Default Values*.

3.2 Preparing the Meter for Calibration

For the best results, select a standard with a concentration close to the concentration of the sample being measured. Alternatively, a calibration standard with a concentration that is approximately 2/3 the full-scale of the measurement range. For example, in the 0 to 2000 µS/cm conductivity range, use a 1413 µS/cm standard for calibration.

Use fresh calibration standards. Reuse of standard solutions may impair the calibration and the accuracy of measurements. Store solutions in a dry, dark, cool environment and limit exposure to air.

Rinse or immerse the probe in clear water before calibration and between samples. Deionized water is ideal.

3.3 Selection of Auto or Manual Calibration (CON 6 PLUS)

The CON 6 PLUS is capable of automatic or manual calibration. The factory default setting is automatic.

In the automatic calibration mode, the CON 6 PLUS will automatically select one of four calibration standard values (see below) depending on the range and normalization temperature being used.

Automatic calibration is useful when all of the calibration standards fall into one of the groups listed below. For example, if the 1413 µS/cm standard reads as 1400 µS/cm during calibration, press "ENTER" to accept this value as 1413 µS/cm using the automatic mode. In manual mode, the increment button would have had to be pressed 13 times to adjust the value to 1413 µS/cm to before pressing "ENTER".

Normalization Temperature	Calibration Standards (Range)
25 °C	1. 84 µS/cm (for 0 – 200 µS/cm) 2. 1413 µS/cm (for 0 – 2000 µS/cm) 3. 12.88 mS/cm (for 0.00 – 20.00 mS/cm) 4. 111.8 mS/cm (for 0.0 – 200.0 mS/cm)
20 °C	1. 76 µS/cm (for 0 – 200 µS/cm) 2. 1278 µS/cm (for 0 – 2000 µS/cm) 3. 11.67 mS/cm (for 0.00 – 20.00 mS/cm) 4. 102.1 mS/cm (for 0.0 – 200.0 mS/cm)

Table 1: Conductivity Calibration Standards for Auto Calibrations

If a calibration standard is used that is not listed above, select manual calibration.

See Section *5.3 Advanced Setup* to modify automatic or manual calibration.

3.4 Using Automatic Calibration (CON 6 PLUS)

In Automatic Calibration mode, the CON 6 PLUS can accept up to 4 calibration points with a maximum of 1 point per measurement range. Note: Values in the 0.00 to 20.00 µS/cm range cannot be calibrated in Auto Calibration mode.

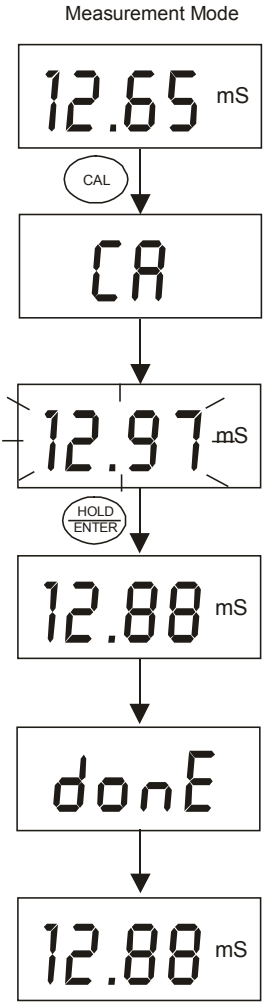
1. If necessary, press the **MODE** key to select the conductivity mode.
2. Rinse the probe with deionized water or a rinse solution. Rinse with a small amount of calibration standard.

NOTE: For Automatic Calibration one of the calibration standards listed in Table 1 must be used.

3. Dip the probe into the calibration standard. Stir gently with the probe to create a homogeneous sample. Allow time for the reading to stabilize.
4. Press the **CAL** key to enter the conductivity calibration mode. The [**CA**] indicator will appear briefly, and then a value will appear flashing.

NOTE: To exit calibration without confirmation, press CAL to return to the measurement mode.

5. When the value is stable, press **ENTER**. The calibration standard value will appear for 3 seconds. If the calibration is successfully performed, [**donE**] will be displayed briefly before meter returns to the measurement mode.
6. Repeat steps 1-5 as needed with additional calibration standards.



NOTES:

- To protect from erroneous calibrations, the allowable tolerance is ±40% of the factory default value. If a calibration is attempted with standards that fall outside of the tolerance range, the error

message "**Err 1**" will be indicated and the meter will return to the measurement mode. For example, a 40% tolerance of a 1413 µS/cm standard is 848 µS/cm to 1978 µS/cm.

- If the measured temperature (°C) of the calibration solution is below 0 °C or above 50 °C, the error message "**Err 2**" will be indicated and the meter will return to the measurement mode.
- Low conductivity standard solutions (less than 20 µS/cm) are unstable and are very temperature dependent. As a result, reproducible calibration results are challenging in the lowest measurement range (0.00 to 20.0 µS/cm).

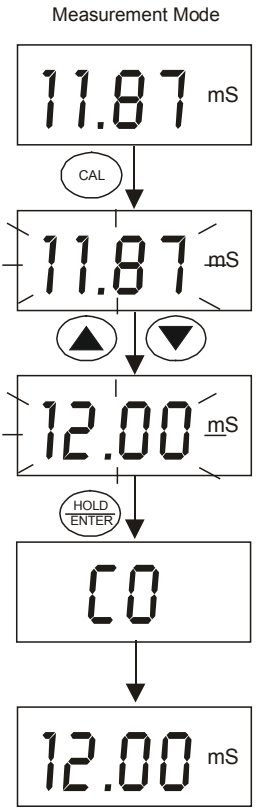
3.5 Manual Calibration

In Manual Calibration mode, the selection of conductivity calibration standards is not limited to those listed previously in Table 1. This example shows a manual calibration sequence using a 12.00 mS/cm conductivity calibration standard.

1. If necessary, press the **MODE** key to select the conductivity mode.
2. Rinse the probe thoroughly with deionized water or a rinse solution. Rinse with a small amount of calibration standard.
3. Dip the probe into the calibration standard. Stir gently with the probe to create a homogeneous sample. Allow time for the reading to stabilize.
4. Press **CAL** to enter the conductivity calibration mode. The [**CA**] indicator will appear briefly, and then a value will appear flashing.

NOTE: To exit calibration without confirmation, press CAL to return to the measurement mode.

5. When the value is stable, press ▲ or ▼ to adjust the value to match the calibration standard.
6. Press **ENTER** to confirm the adjusted value. [**CO**] will appear briefly indicating that the calibration was successful. The meter will return to measurement mode.
7. Repeat steps 1-6 as needed with additional calibration standards.

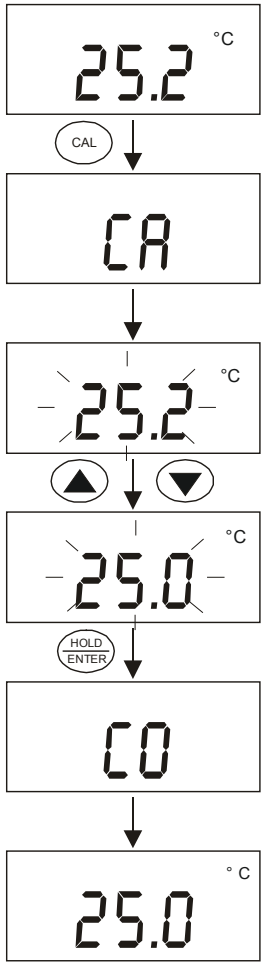


3.6 Temperature Calibration

The probe includes a built-in temperature sensor that is factory calibrated with the meter. Perform the temperature calibration only if it is suspected that temperature errors may have occurred over time or when the probe is replaced.

The temperature reading can be offset up to ±5 °C from the original (default) reading.

1. Connect the mini phono jack of the temperature sensor to the meter. See *Section 2.7*.
2. If necessary, press **MODE** to select the temperature measurement mode.
3. Press **CAL** to initiate the temperature calibration. "**CA**" will appear briefly then a temperature value will start flashing.
4. Dip the probe into a solution with a known temperature (for example, a temperature bath). Stir gently with the probe. Allow time for the temperature to stabilize.
5. When the value is stable, press ▲ or ▼ to adjust the value to the solution temperature.
6. Press **ENTER** to confirm the adjusted value. [**CO**] will appear briefly indicating that the calibration was successful. The meter will return to the measurement mode.



NOTE: To exit calibration without confirmation, press **CAL** to return to the measurement mode.

4. MEASUREMENT

The meter is capable of taking measurements that incorporate temperature measurements automatically (most common) or using a temperature which is input manually (rare).

4.1 With Automatic Temperature Compensation (ATC)

To compensate the reading using temperature values as measured by the electrode, attach the phono jack of the temperature sensor to the meter. The measured reading will be automatically compensated to the specified normalization temperature (either 20 °C or 25 °C). The rate of compensation which is applied is the Temperature Coefficient.

See Section *5.5 – Temperature Coefficient*.

See Section *5.6 – Normalization Temperature*.

4.2 Without ATC (Manual Temperature Compensation)

Manual temperature compensation will be applied after manually entering the temperature value into the meter. The meter will compensate from this fixed value to the normalization temperature. Any temperature can be used between 0 and 50 °C. The default value is 25 °C.

To activate the manual temperature compensation, unplug the mini phono jack of the temperature sensor from the meter and follow the steps 2 thru 6 of Temperature Calibration.

See Section *3.6 – Temperature Calibration*.

4.3 Taking Measurements

1. Rinse the probe with deionized or distilled water before use to remove any impurities. Shake or air dry. To avoid contamination or sample dilution, rinse the probe with a small volume of the sample.
2. Dip the probe into the sample. Stir the sample gently with the probe.
3. Allow time for the reading to stabilize. Note the reading on the display.

NOTE:

- The protective probe guard must be attached during measurement. Erroneous results will occur while the probe guard is removed.

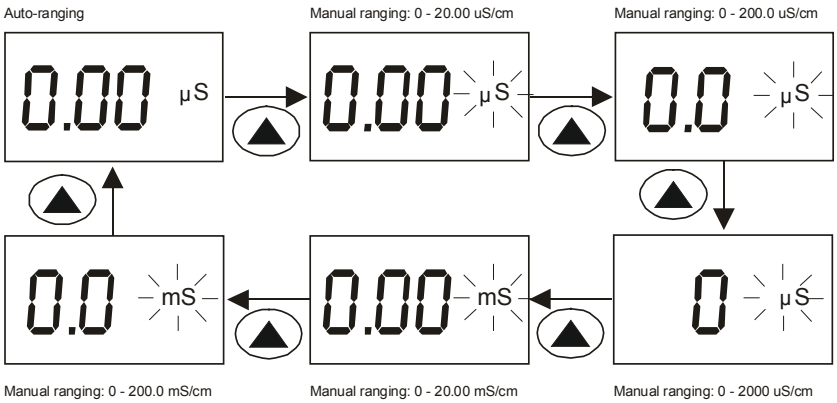
- Always immerse the probe beyond upper steel band for best results. Use the fill line on the outside of the probe guard for reference.

4.4 Using the Manual Ranging Function

By default the meter has auto-ranging ability and automatically selects the range in which the readings appear.

Alternatively, to override the auto-ranging function, a specific range can be manually selected by pressing ▲ successively for each measurement range. The five ranges are:

Conductivity Range (CON 6 PLUS)	TDS Range (TDS 6 PLUS) (using 0.5 TDS factor)
0 – 20.00 µS/cm	0 – 10.00 ppm
0 – 200.0 µS/cm	0 – 100.0 ppm
0 – 2000 µS/cm	0 – 1000 ppm
0 – 20.00 mS/cm	0 – 10.00 ppt
0 – 200.0 mS/cm	0 – 100 ppt



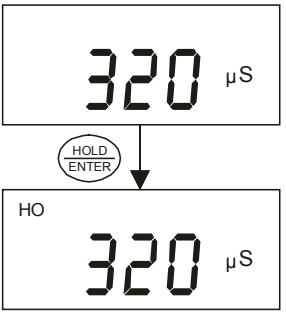
NOTE:

- If the value of the solution that is being measured is higher than the range selected, [**Or**] (over range) will appear. Press ▲ to select a measurable range.
- The meter will reset to the Auto-ranging function when the meter is turned off.

4.5 HOLD Function

For prolonged viewing of a reading, press **HOLD** while in measurement mode to freeze the display.

1. To hold a measurement, press **HOLD** while in measurement mode. [**HO**] will appear on the display.
2. To release the held value, press **HOLD** again. [**HO**] will disappear and measurement will resume.



NOTE:

- The meter will shut off automatically 20 minutes after the last key press.
- If the meter is shut off either automatically or manually, the **HOLD** value will be lost.

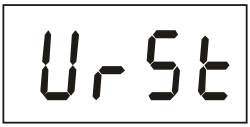
5. ADVANCED SETUP FUNCTIONS

5.1 Advanced Setup Overview

Advanced setup allows customization settings such as; selecting the electrode cell constant, normalization temperature, temperature coefficient, TDS factor (TDS 6 PLUS), automatic or manual calibration (CON 6 PLUS), single-point or multi-point calibrations (CON 6 PLUS and TDS 6 PLUS), and to reset meter to factory default.

To enter advanced setup mode:

1. Switch off the meter.
2. Press **MODE** and then **ON**, holding both keys for 2 seconds. Release the **ON** key before releasing the **MODE** key.
3. If successful, [**StUP**] will appear briefly followed by [**CELC**].
4. Press ▲ or ▼ to select the desired advanced setup function.

	Entering Advanced Setup Mode
	Cell Constant. Select k = 0.1, 1.0, or 10.0. Default value is 1.0.
	Select Automatic Calibration. “Yes” for auto calibration and “No” for manual calibration. Default value is “Yes”. (CON 6 PLUS only)
	Adjust Temperature Coefficient from 0.0 to 3.0 % per °C. Default value is 2.1 % per °C.
	Normalization Temperature. Select “20 °C” or “25 °C”. Default value is 25 °C.
	Adjust TDS factor from 0.4 to 1.0. Default value is 0.5. (TDS 6 PLUS only)
	Select Single Point Calibration. Select “Yes” or “No”. Default value is “Yes”.
	User reset to factory defaults. Select “Yes” or “No”. Default value is “no”.

5.2 Selecting the Cell Constant

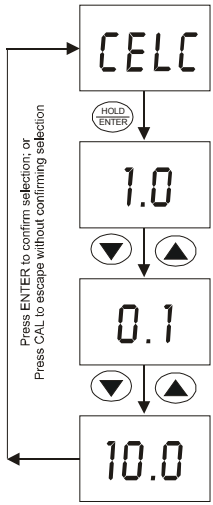
The meter includes a probe with a nominal cell constant (k) of 1.0. Use probes with k = 0.1 and 10 (not provided) for improved performance in extreme samples. Use this setup function to change the cell constant if necessary. Meter default is 1.0 to match the probe supplied with the meter.

k = 0.1 ideal for low measurements <20 µS/cm (<10 ppm).

k = 1.0 ideal for mid-range measurements

k = 10 ideal for high measurements >20 mS/cm (>10 ppt).

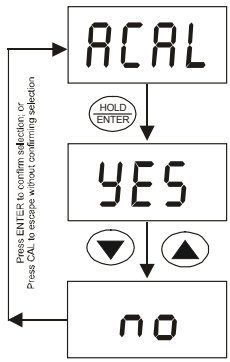
1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**CELC**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select "1.0", "0.1" or "10.0". Ensure that the cell constant corresponds with the probe being used.
4. Press **ENTER** to select and return to [**CELC**] setup function.
5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to measurement mode.



5.3 Automatic Calibration (CON 6 PLUS only)

Select automatic calibration "YES" to chose four factory pre-set conductivity calibration standards (see Section *3.3 Table 1*). To use other standards, or to calibrate any standard manually select "no". The default value is "YES".

1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**ACAL**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [**YES**] or [**no**].
4. Press ENTER to select and return to [**ACAL**] setup function.
5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to the measurement mode.

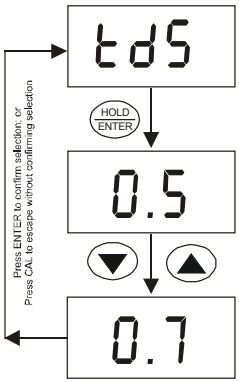


5.4 Setting the TDS Factor (TDS 6 PLUS only)

As the concentration of salts dissolved in solution increases, the conductivity will increase. This relationship varies from salt to salt and is roughly linear over a given range for a given salt. The TDS conversion factor is the number used by the meter to convert from conductivity to TDS.

The TDS conversion factor can be set from 0.4 to 1.0. The default value is 0.5.

See Section *13 – Calculating TDS Conversion Factor*.



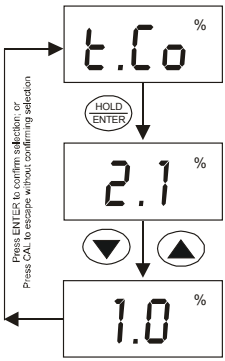
1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**tdS**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select the desired **TDS** factor.
4. Press **ENTER** to select and return to the [**tdS**] setup function.
5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to the measurement mode.

5.5 Temperature Coefficient

The temperature coefficient is the amount of change in conductivity per degree temperature (% per °C). For best results, determine and enter the exact temperature coefficient of the solution. The meter will allow values from 0.0 to 3.0 % per °C. The default value is 2.1 % per °C.

Note: Select 0.0% for uncompensated measurements. The temperature will be measured by the probe and displayed.

See Section *14 – Calculating Temperature Coefficients*.

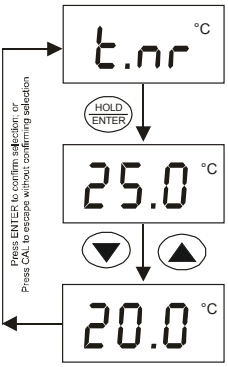


1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**t.Co %**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select a value between 0.0 to 3.0%.
4. Press **ENTER** key to select and return to the [**t.Co %**] setup function.

5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to the measurement mode.

5.6 Normalization Temperature

The meter can be set to normalize the measurements to a temperature of either 25 °C or 20 °C. The default value is 25 °C.

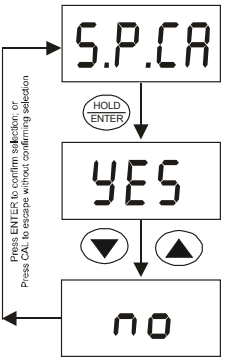


1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**t.nr °C**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [**25.0 °C**] or [**20.0 °C**].
4. Press **ENTER** to select and return to the [**t.nr °C**] setup function.
5. Press ▲ or ▼ to move to the next setup function or press **CAL** to exit to the measurement mode.

5.7 Single-Point Calibration

Select “YES” to apply a single calibration value across all ranges.

Select “no” to allow separate calibrations for each range, or to restrict an individual calibration so that it is applied to one range only. The default value is “Yes”.



1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ until [**S.P.CA**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [**Yes**] or [**no**].
4. Press **ENTER** to select and return to the [**S.P.CA**] setup function.
5. Press ▲ or ▼ to move to the next setup function menu or press **CAL** to exit to the measurement mode.

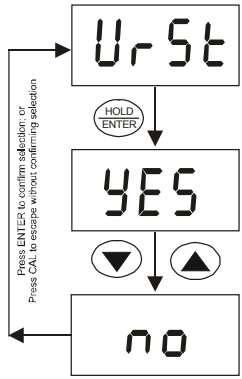
5.8 Restore Factory Default Values

Use this function to reset all parameters to factory default settings. This will clear all calibration data and any other setup functions that might have been changed.

IMPORTANT: Once the reset function has been activated the settings and calibration data will be erased and cannot be restored

.

1. Enter advanced setup as described in Section 5.1.
2. Press ▲ or ▼ key until [**UrSt**] appears. Press **ENTER**.
3. Press ▲ or ▼ to select [**Yes**] or [**no**].
4. Press **ENTER** to confirm.
5. If reset [**Yes**] confirmed, the meter will return to the measurement mode after initialization.

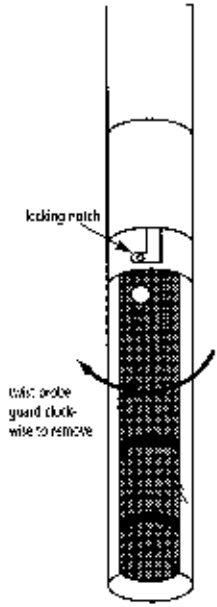


PROBE CARE AND MAINTENANCE

Keep the probe clean. Rinse the probe twice, and gently swirl it while readings are being taken. For best results, soak a dry probe for at least 5-10 minutes before calibration. Rinse the probe with clean water before storing. Never scratch the bands with an abrasive or hard substance. Do not strike the probe against hard surfaces or submerge the cable for extended periods.

Do not immerse the probe in oily solutions, aggressive solvents, or strong acids. Clean the probe with a mild detergent or isopropyl alcohol then rinse thoroughly. Dry storage is acceptable. Recalibrate the probe after cleaning.

The conductivity probe features a removable probe guard for easy cleaning. To remove the guard — grip the yellow probe guard and twist it clockwise to release the locking notch, and then slide it off.



NOTE: Remember to reattach the probe guard before use – failure to do so will result in erroneous readings!

7. TROUBLESHOOTING

Problem	Cause	Solution
No display	Batteries are not installed, were improperly installed, or are too weak	Install batteries with correct + / - polarity. Replace with new batteries
"LO" displays in the LCD	Low battery	Replace batteries
Unstable readings	a) Air bubbles in probe b) Dirty probe c) Probe not immersed deeply enough d) External noise pickup or induction caused by nearby electric motor e) Broken probe	a) Tap probe to remove bubbles b) Clean probe & recalibrate c) Make sure sample entirely covers the probe sensors d) Move or switch off interfering motor e) Replace probe
Slow response	Dirty / Oily probe	Clean & recondition probe
Inaccurate readings / can't calibrate	Probe guard not installed or calibration solution incorrect	Install probe guard & replace calibration solutions
"Er1" CON 6 PLUS TDS 6 PLUS	Attempted calibration value was not within the ±40% auto calibration window	Check the value of the conductivity calibration solution. Switch to manual calibration mode and re-calibrate
"Er2" Temperature calibration error	Auto calibration was not within (0 – 50 °C) temperature range	Ensure that the temperature is within the acceptable range

8. SPECIFICATIONS / FEATURES

		CON 6 PLUS	TDS 6 PLUS
Conductivity Ranges (Resolution)	0 to 20.00 (0.01) µS/cm 20.0 to 200.0 (0.1) µS/cm 200 to 2000 (1) µS/cm 2.01 to 20.00 (0.01) mS/cm 20.1 to 200.0 (0.1) mS/cm	✓	
TDS Ranges (Resolution)	0 to 10.00 (0.01) ppm 10.0 to 100.0 (0.1) ppm 100 to 1000 (1) ppm 1.01 to 20.00 (0.01) ppt 20.1 up to 200.0* (0.1) ppt *depending on TDS factor used		✓
Accuracy	±1% full scale	✓	✓
Temperature Resolution Accuracy	-10.0 to 110.0 °C 0.1 °C ±0.5 °C	✓	✓
Cell Constant	Selectable	0.1, 1, 10	0.1, 1, 10
Temperature Compensation	Automatic / Manual (from 0 to 50 °C)	✓	✓
Temperature Coefficient	0.0 to 3.0% per °C	✓	✓
Normalization Temperature	25.0 , 20.0 °C (selectable)	✓	✓
TDS factor	0.4 to 1.0	✓	✓
Calibration points	Maximum 1 per range	5	5
Auto- or Manual-ranging	Selectable	✓	✓
Auto standard recognition	Selectable	✓	✓

FEATURES	
Auto-Buffer Recognition	Yes (CON 6 PLUS)
Hold Function	Yes “HO”
Low Battery Indicator	Yes “LO”
Auto Shut Off	20 minutes after last key operation
Display	Custom LCD
Operating Temperature	0 to 50 °C
Power Requirements	(4) AAA alkaline batteries (included)
Battery Life	>100 hours
Meter Dimensions / Weight	15.7 x 8.5 x 4.2 cm / 255 g

9. CONDUCTIVITY THEORY

Conductance is a quantity associated with the ability of primarily aqueous solutions to carry an electrical current (I) between two metallic electrodes when a voltage (E) is connected to them. Though water itself is a rather poor conductor of electricity, the presence of ions in the water increases its conductance considerably, the current being carried by the migration of the dissolved ions. This is a clear distinction from the conduction of current through metal, which results from electron transport.

The conductance of a solution is proportional to and a good, though non-specific indicator of the concentration of ionic species present, as well as their charge and mobility. It is intuitive that higher concentrations of ions in a liquid will conduct more current. Conductance derives from Ohms law, E = IR, and is defined as the reciprocal of the electrical resistance of a solution.

$$C = 1/R$$

where C is conductance (siemens)
R is resistance (ohms)

One can combine Ohms law with the definition of conductance, and the resulting relationship is:

$$C = I/E$$

where I is current (amps)
E is potential (volts)

In practice, conductivity measurements involve determining the current through a small portion of solution between two parallel electrode plates when an AC voltage is applied. Conductivity values are related to the conductance (and thus the resistance) of a solution by the physical dimensions—area and length—or the cell constant of the measuring electrode. If the dimensions of the electrodes are such that the area of the parallel plates is very large, it is reasonable that more ions can reside between the plates, and more current can be measured. The physical distance between the plates is also critical, as it affects the strength of the electric field between the plates. If the plates are close and the electric field is strong, ions will reach the plates more quickly than if the plates are far apart and the electric field is weak. By using cells with defined plate areas and separation distances, it is possible to standardize or specify conductance measurements.

Thus derives the term specific conductance or conductivity.

The relationship between conductance and specific conductivity is:

Specific Conductivity, S.C. = (Conductance) (cell constant, k)
= siemens * cm/cm^2
= siemens/cm

where C is the conductance (siemens)
k is the cell constant, length/area or cm/cm^2

Since the basic unit of electrical resistance is the ohm, and conductance is the reciprocal of resistance, the basic unit of conductance was originally designated a “mho”—ohm spelled backwards—however, this term has been replace by the term “siemens”. Conductivity measurements are reported as Siemens/cm, since the value is measured between opposite faces of a cell of a known cubic configuration. With most aqueous solutions, conductivity quantities are most frequently measured in microsiemens per cm (µS/cm) or millisiemens per cm (mS/cm).

The salinity value which ranges from 2 to 42 is a measure of all salts, not just sodium chloride. This scale was originally devised for seawater, and is based on seawater at 15 °C having a conductivity equivalent to that of a potassium chloride solution of a known concentration. This solution (0.44 molar) is defined as having a salinity of 35 ppt.

The total dissolved solids scale approximates the ppm TDS in surface waters by multiplying the conductivity of a sample by a factor, 0.66.

Some users prefer the use of resistivity units to describe their water,

particularly where high purity water is involved. The unit most often used to describe resistivity is megohm-cm, which are simply the reciprocal of conductivity (µS/cm). The chart below shows the relationship between these units.

Conductivity (µS/cm)	Resistivity (megohm-cm)
0.056	18
0.1	10
1.0	1.0
2.5	0.4
10.0	0.1

Conductivity and Temperature

Conductivity in aqueous solutions reflects the concentration, mobility, and charge of the ions in solution. The conductivity of a solution will increase with increasing temperature, as many phenomena influencing conductivity such as solution viscosity are affected by temperature.

The relationship between conductivity and temperature is predictable and usually expressed as relative % change per degree centigrade. This temperature coefficient (% change per degree) depends on the composition of the solution being measured. However, for most medium range salt concentrations in water, 2% per degree works well. Extremely pure water exhibits a temperature coefficient of 5.2%, and concentrated salt solutions about 1.5%.

Since temperature affects the conductivity measurement so profoundly, the usual practice is to reference the conductivity to a standard temperature—typically 25 °C. Select 20 °C or 25 °C as the normalization temperature in advanced setup.

Enter the temperature coefficient which best suits the sample and use an ATC probe to automatically temperature compensate back to the chosen reference temperature.

10. CALIBRATION TIPS

Only one calibration is needed for measurement throughout the entire range of the meter. If a range was not calibrated, the meter will automatically detect the closest range calibrated and use that calibration information. However, only the ranges that were calibrated have maximum accuracy.

If the samples being measured are near to, or greater than 20 mS/cm (10 ppt), or near to or lower than 100 µS/cm (50 ppm), it is suggested that the meter be calibrated at least weekly.

If the samples being measured are in the mid-range and the probe is rinsed with deionized water and stored dry, the suggested calibration frequency is at least monthly.

Wet the probe for 10 minutes before calibrating or taking readings to saturate the probe surface and minimize drift. If measurements are taken at extreme temperatures, calibrate the meter at least once a week.

Only probes specified for the CON 6 PLUS and TDS 6 PLUS meters should be used. These probes have a built-in temperature sensor. If a probe without a temperature sensor is used, the temperature of the solution must be measured separately and entered manually.

11. CALCULATING TDS CONVERSION FACTOR

The meter can be calibrated with TDS calibration standard solutions. The calibration standard must be the TDS value at a standard temperature such as 25 °C. To determine the conductivity-to-TDS conversion factor use the following formula:

$$\text{Factor} = \text{Actual TDS} \div \text{Actual Conductivity @ 25 °C}$$

Actual TDS: Value from the solution bottle label or standard prepared with high purity water and precisely weighed salts.

Tip: ppm = milligrams of salt per liter of water

Actual Conductivity: Value measured using a properly calibrated Conductivity/Temperature meter.

Both the Actual TDS and the Actual Conductivity values must be in the same magnitude of units. For example, if the TDS value is in ppm the conductivity value must be in µS/cm; if the TDS value is in ppt the conductivity value must be in mS/cm.

Check the factor by multiplying the conductivity reading by the factor in the above formula. The result should be in TDS value.

Tip: When the TDS factor is set to 1.0, Conductivity = TDS.

12. CALCULATING TEMPERATURE COEFFICIENTS

To determine the temperature coefficient of the sample solution:

$$t_c = 100 \times \frac{C_{T2} - C_{T1}}{C_{T1}(T_2 - 25) - C_{T2}(T_1 - 25)}$$

Where:

t_c	=	Temperature coefficient	25	=	25 °C
C_{T1}	=	Conductivity at Temp 1	T_1	=	Temp 1
C_{T2}	=	Conductivity at Temp 2	T_2	=	Temp 2

NOTE: A controlled temperature water bath is ideal for this procedure.

1. Immerse the probe in the solution. Stir gently. Adjust the temperature coefficient to 0% (no compensation) by following the instructions in Section 6.5 – Temperature Coefficient.
2. Wait 5 minutes. Stir gently. Note $\mathbf{T_1}$ and $\mathbf{C_{T1}}$ (conductivity at $\mathbf{T_1}$).
3. Condition the sample solution and probe to a temperature ($\mathbf{T_2}$) that is about 5 °C to 10 °C different from $\mathbf{T_1}$, and note the conductivity reading $\mathbf{CT_2}$.

NOTE: Record the results for future reference. Ideally $\mathbf{T_1}$ and $\mathbf{T_2}$ should bracket the measurement temperature, and should not differ by more than 5 °C.

4. Calculate the temperature coefficient of the solution according to the formula shown above.
5. Enter the calculated temperature coefficient into the meter.

See Section *5.5 – Temperature Coefficient*.

The calculated temperature coefficient will now be applied to all the meter readings.

13. REPLACEMENT PARTS AND ACCESSORIES

Description	Code
CON 6 PLUS meter with probe and case	5-0039-02
TDS 6 PLUS meter with probe and case	5-0037-02
Replacement probe with BNC & ATC plug, k = 1.0, 1 m cable	5-0106
Calibration Standards	
84 µS/cm, 30 mL	6312-G
1413 µS/cm, 100 mL	6354-J
12.88 mS/cm, 30 mL	6317-G

14. WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 3 years from the date of shipment and the probe to be free of defects in parts and workmanship for 6 months from the date of shipment. If it should become necessary to return the instrument for service during or beyond the warranty period, contact our Technical Service Department at 1-800-344-3100 or tech@lamotte.com for a return authorization number or visit www.lamotte.com for troubleshooting help. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. LaMotte Company specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. LaMotte Company's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

To **Register Your Meter** with the LaMotte Service Department, go to www.lamotte.com and choose "SUPPORT" on the top navigation bar.

15. REPAIRS

Should it be necessary to return the meter for repair or servicing, pack the meter carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 800-344-3100 (US only) or 410-778-3100, faxing 410-778-6394, or emailing tech@lamotte.com. Often a problem can be resolved over the phone or by email. If a return of the meter is necessary, attach a letter with the return authorization number, meter serial number, a brief description of problem and contact information including phone and FAX numbers to the shipping carton. This information will enable the service department to make the required repairs more efficiently.

PO Box 329 · Chestertown · MD · 21620 · USA
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www.lamotte.com

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